Title: Plotting Whole Numbers and Fractions On A Number Line

Brief Overview:

This lesson introduces plotting and labeling points on a number line. Students will first plot whole numbers and then fractions on number lines. It is expected that students are familiar with fractions up to fourths, number lines, and the following vocabulary: *whole numbers, difference, pattern, rule, fraction, numerator, denominator, equal parts.*

NCTM Content Standard:

Understand numbers, ways of representing numbers, relationships among numbers, and number systems

- develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers;

Understand patterns, relations, and functions

- represent and analyze patterns and functions, using words, tables, and graphs.

Grade/Level:

Grade 3

Duration/Length:

3 sessions, for 60 minutes per session.

Student Outcomes:

Students will:

- Identify, locate, and represent points on a number line
- Represent and analyze numeric patterns using skip counting

Materials and Resources:

<u>Day One</u>

- Student resource "Show What You Know!!! - ½ sheet per student
- Clothesline to hang across classroom for a hanging number line
- Clothespins spaced evenly across the hanging number line
- Teacher resource "Dave's Disorderly Dogs"

- Student resource "Dave's Dogs Number Cards" Precut number cards one through ten
- Student resource "Them Bones"
- Student resource "Number Bones" Cut out each bone and place each numbered set of bones into a baggy, marking the set number on the bag prior to the lesson
- Student resource "What's the Difference?"
- Student resource "Plotting Points on a Number Line"
- Teacher resource "Plotting Points on a Number Line" transparency
- Student resource "Number Line Exit Bone"

Day Two

- Student resource "Exploration Number Line Day Two"– ½ sheet per student
- Teacher resource "Exploration Number Line Transparency Day Two"
- Small tiles labeled with whole numbers 1-10
- Fraction strips
- Student resource "Fractions on a Number Line"
- Teacher resource "Fractions on a Number Line" transparency made from student resource
- Lined notebook paper
- Ruler
- Student resource "Fractions on a Number Line Exit Card"

Day Three

- Teacher resource "Engagement Whole Number Cards" 0-4
- Teacher resource "Fraction Cards" (fourths)
- Student resource "Exploration Number Line Day Three" – ½ sheet per student
- Teacher resource "Exploration Number Line Transparency Day Three"
- Student resource "Fraction Square Puzzle" – This resource sheet should be copied so that one puzzle is available for two students. It is suggested that the resource sheet be glued to a piece of cardstock paper before cutting the squares out and then laminate if possible. Place the puzzle pieces in baggies before distributing to students.
- Lined notebook paper
- Ruler
- Fraction strips
- Student resource "Mixing It Up"
- Student resource "Plotting Points Summative Assessment"

Development/Procedures:

Day 1

Pre-assessment

- Distribute pre-assessment student resource "Show What You Know!" for students to complete.
- Collect pre-assessments to diagnose readiness and possibly develop small intervention groups. An answer key is provided.

Engagement

- Access teacher resource "Dave's Disorderly Dogs." Read the story to the students.
- Challenge students to think of ideas to help Dave and his dogs get started every morning.
- Allow students a minute to think of a solution independently. Then, encourage students to discuss possible solutions with a partner.
- Choose 10 students and give one "Dave's Dogs Number Card" to each student. Tell those ten students to stand in the front of the room. Ask the remaining students to direct those ten students to hang their *Dave's Dogs Cards* in order on the hanging number line.
- Connect the clothesline to a number line by discussing the similarities (i.e., numbers increase left to right, it represents order, etc.).
- Discuss the importance of having equal spacing between the numbers on the hanging number line.
- Tell students, "Buzz and Koda have to leave the group to go to the bathroom but they'll be back!" Remove *Dave's Dogs Cards* two and four from the clothesline, leaving the clips in their places.
- Tell students, "Now Apollo and Champ decide they need to go to the bathroom so off they go!" Remove *Dave's Dogs Cards* six and eight from the clothesline, leaving the clips in their places.
- Tell students that even though Buzz, Koda, Apollo, and Champ have left their place in the number line, their spots in the line are still there. Point to the empty clips to show the missing dogs' spots on the number line. Discuss that the number line is still intact and that the missing numbers are still there, but they just can't see the labels.
- Ask students if they notice any kind of pattern having to do with the missing labels on the number line (pattern skip-counts by two).

Exploration

- Provide each small group with one copy of student resource "Them Bones!" Distribute baggies of number bones as follows: group one gets set one and two; group two gets sets three and four; group three gets sets five and six. If the class has more than three small groups, repeat number bones sets so that groups get two sets each.

- Direct students to place the bones on the correct point on their student resource "Them Bones!" number lines. Tell students to determine the skip-counting pattern on their number lines. Circulate and assist as necessary.
- Take anecdotal notes while observing how students apply their own problem solving skills.

Explanation

- Call on each group of students to share their strategies for placing their bones on their number lines.
- Confirm, clarify, and refine student thinking through discussion about how they determined the skip-counting patterns on their number lines. Use teacher resource "What's the Difference?" as a guide.
- Strategies may include finding the difference between two numbers that are next to each other by using the counting-up or counting-back strategy and/or subtraction.
- Distribute student resource "Plotting Points on a Number Line" to all students.
- Display a copy of this resource on transparency on the overhead projector.
- Model the way to find the difference between 15 and 18, the two numbers that are next to each other, in order to state the skip-counting rule. Plot and label the missing numbers on the first number line. Tell students to do the same on their first number line.
- Elicit responses from students to the following questions in order to plot the points on the second number line:

  "Who can tell me what two numbers will help us determine the skip-counting pattern on this number line? (166 & 176)
  "What would be a good strategy for finding the difference between the two numbers?" (Start at 166 and count up to 176, start at 176 and count back to 166, **or** subtract 176 – 166.)
  "Now that we know the difference, how will we use that information to plot the missing points on this number line?"

- Call on students to tell you how to plot and label the missing numbers on the second number line.

Application

- Direct students to work with a partner to find the difference, state the skip-counting pattern, plot, and label the missing numbers on the third and fourth number lines.
- Circulate and observe as partners work together to determine the missing numbers on their number lines. Take anecdotal notes to help you form a small group who may need reteaching and reinforcement. For those students showing understanding of the concepts and strategies, direct them to complete number lines five and six independently. An answer key is provided.

Differentiation

Reteach

- Provide students with student resource "What's the Difference?" Assist them in applying the steps for finding the difference between given numbers on their number lines in order to determine the skip-counting patterns.

Enrich

- Tell students to create their own number lines using pencil and paper based on the following requirements:

  The number line must show at least four whole numbers between 250 and 500; and,

  The number line must show skip counting by some value other than two, five, ten, or one hundred.

  (The above directions are provided as a Challenge on student resource "Plotting Points on a Number Line".)

Assessment

- Distribute student resource "Number Line Exit Bone" and have students label the missing points. An answer key is provided.

Day 2

Engagement

- Distribute dry erase boards, erasers, and markers to all students.
- Direct students to draw two squares on their dry erase boards and divide those squares into fourths in two different ways.
- Ask students to share their drawings and explain how they showed fourths. Students should include "four **equal** parts" in their explanations.
- Review the meaning of the vocabulary word, "fractions."

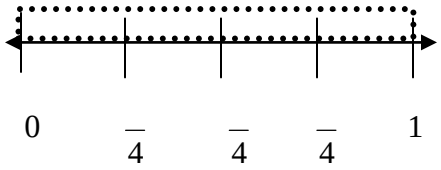
Exploration

- Distribute student resource "Exploration Number Line" to pairs of students.
- Distribute an assortment of number tiles and fraction strips to each pair of students.
- Direct students to work with a partner to label the missing numbers on their number lines.
- Tell students they may use any of the manipulatives you distributed.
- Circulate and observe students' strategies as they work.
- Take anecdotal notes while observing how students apply their own problem solving skills.

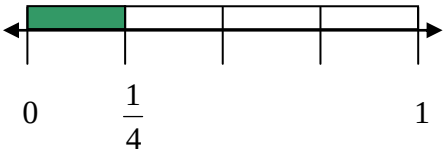
Explanation

- Display teacher resource "Exploration Number Line Transparency."
- Challenge students to share their strategies and solutions. Ask them to explain their choice of manipulatives.

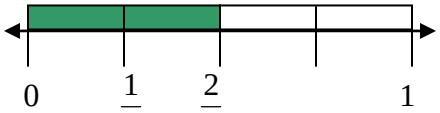
- If students use number tiles to label 1, 2, 3, 4, then direct their attention to the beginning and ending numbers on the number line (zero and one). Show students that this number line is one whole that has been broken into equal parts.
- Show students how to draw a rectangle on the upper portion of the number line beginning at the zero and continuing to the one as follows. Ask the students to count the parts of the rectangle out loud with you. Tell students, "Since we now know our number line is broken into four equal parts, or fourths, let's go ahead and begin labeling the tick marks with the denominator."



- Show students how to shade the first part of the number line as follows:



- Say: "We've just shaded one of four equal parts. Now we can fill in the numerator so that our first tick mark is labeled $\frac{1}{4}$."
- Shade and fill in the numerator for $\frac{2}{4}$.



- Continue the same procedure for labeling $\frac{3}{4}$ on this number line.
- Ask: "Now we know that the last tick mark on our number line is already labeled with a one. Is there another way we could show what this tick mark represents?" ($\frac{4}{4}$) Tell students, "Since the rest of the tick marks on our number line are labeled with fractions, I think we should go ahead and label the one with its equivalent fraction, ($\frac{4}{4}$).
- Display student resource "Fractions on a Number Line" transparency on the overhead.
- Distribute student resource "Fractions on a Number Line" to all students.
- Direct students' attention to the first number line. Emphasize the beginning and ending points (zero and one) and tell students that this is how we know that this number line shows fractional parts.
- Read the directions, emphasizing the fact that the students will be labeling only the tick mark represented by a letter. An answer key is provided.

- Use an overhead marker to draw a rectangle on the upper portion of the number line beginning at the 0 and continuing to the one. Show students how to count the total number of parts on the first number line following the same procedures from the student resource "Exploration Number Line."
- Tell students the total number of parts is the denominator in the fraction. Write the denominator under point A.
- Model how to shade up to point A and count the shaded part following the same procedures from the student resource "Exploration Number Line." Tell students this is one of three equal parts so it will be the numerator in the fraction. Write the numerator over the denominator under Point A.
- Tell students to shade and label their first number line just as you modeled it on the transparency.
- Use the following questions to help students plot the points on the second number line:

  "What would be a good strategy to label point B? (Draw a rectangle from the 0 to the 1. Count the total number of parts first and write the denominator under point B.)
  How can you determine the numerator for point B?
  (Shade the parts up to point B. Count the number of parts you shaded and write the numerator over the denominator under point B.)

- Tell all students to shade and label the second number line.

Application

- Direct students to work with a partner to shade and label the plotted points on number lines three and four.
- Circulate and observe as partners work together to label the plotted points on their number lines. Take anecdotal notes to help you form a small group of students who may need reteaching and reinforcement. Those students who show understanding of the concepts and strategies may complete number lines five through eight independently.

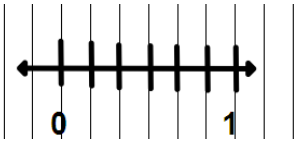
Differentiation

Reteach

- Use the fraction strips with a small group in order to develop a concrete understanding of fractions on the number lines.

Enrich

- Tell students to use lined notebook paper turned sideways to create their own number line. Tell them to use a ruler to make their number lines straight. Show them how the lines on the notebook paper can be used for their tick marks.



- Students will create their number lines based on the following requirements:
- The number line must show fractional parts of at least sixths with at least two tick marks labeled with a letter.
- Students will trade their number lines with a partner. Partners will follow the strategies in the lesson to label each other's number lines. The number line must show the procedures used during the lesson (drawing the rectangle on the top portion of the number line and shading in each fractional piece).

Assessment

- Distribute student resource "Fractions on the Number Line Exit Slip." An answer key is provided.

Day 3

Engagement

- Hang a zero card at the left end of the hanging number line. Be sure to only have five additional clips that are evenly spaced to the right of the zero.
- Choose four students and give one whole number card made from student resource, "Engagement Whole Number Cards" to each student. Tell those five students to stand in the front of the room. Ask the remaining students to direct those four students to hang their whole number cards in order on the hanging number line.
- After checking to see that students have ordered their numbers correctly on the number line, go to the last clip and hang a card with the number "1".
- Ask students how placing the one at the end of the number line changes things. Students should be able to tell you that the number line should be showing fractions since **i**t goes from zero to one.
  Have four students choose one fraction card made from student resource "Engagement Fraction Number Cards" to replace the whole numbers on the number line.
- Point to the one card at the end of the number line and ask, "If I wanted to label this one with a fraction, how could I do that?" Call on a student to write the fraction on the board.

Exploration

- Distribute student resource "Exploration Number Line Day 3" to pairs of students.
- Place fraction strips in a central location and tell students they may use them as needed.
- Direct students to work with a partner to label the points represented by the letters A, B, and C on their number lines.
- Circulate and observe students' strategies as they work.
- Take anecdotal notes while observing how students apply their own problem solving skills.

Explanation

- Display teacher resource "Exploration Number Line Transparency Day 3."
- Call on students to share their strategies and solutions. ($\frac{1}{8}, \frac{2}{8}, \frac{3}{8}$ . . . . 1)
- Choose a student to come to the overhead and draw a rectangle on the upper portion of the number line beginning at the zero and continuing to the one. Follow the same procedures during the Explanation of Day Two. Ask the students to count the parts of the rectangle aloud with you (8 equal parts).
- Ask: "Now what should we do?" (Label the denominators for points A, B, and C.)
- Invite another student to come to the overhead and label the denominators.
- Ask: "Now what should we do?" (Shade and count the parts up to Point A and then label the numerator for Point A.)
- Choose another student to come to the overhead and label the numerator for Point A.
- Ask: "What should we do next?" (Shade and count the parts to Point B and then label the numerator for Point B.)
- Call another student to come to the overhead and label the numerator for Point B.
- Repeat the above steps for labeling the numerator for Point C.
- Tell students to check their work to be sure it looks like the one on the overhead.

Application

- Distribute student resource "Fraction Square Puzzle," baggies to pairs of students.
- Say: "You have nine puzzle pieces in your baggy. Only the matching sides may touch. When you are finished you will have a 3 x 3 square." Model one match so that students understand how to put their puzzles together.
- Circulate and observe as partners work together to label the plotted points on their number lines. Take anecdotal notes to help you form a small group of students who may need reteaching and reinforcement.

Differentiation

Reteach

- Use lined notebook paper and fraction tiles to work with a small group to plot fractional points on a number line. Assist students in making their own number lines on the lined notebook paper turned sideways. Use the lines on the paper to help students shade and count the fractional parts on the number lines.

Enrich

- Use student resource "Mixing It Up" which includes number lines with mixed numbers for your highly able students.

Summative Assessment:
Distribute student resource "Plotting Points on a Number Line Summative Assessment" to each student. The students will label number lines with whole numbers and fractions. The students will also answer a BCR based on their knowledge of plotting fractions on a number line. An answer key is provided.

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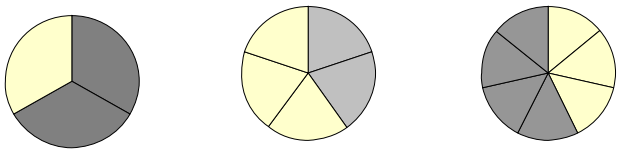
Show What You Know!

Directions: Fill in the missing numbers.

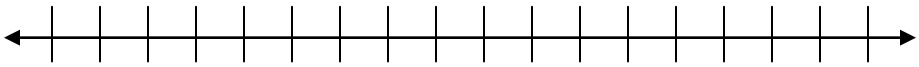
1) 3, 6, ____, _____, 15, ____, _____ 2) 25, 20, ____, _____, 5, ____

3) Identify the fraction of the shaded parts of each shape.



____ ____ ____

4) Label the number line.



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Name _____

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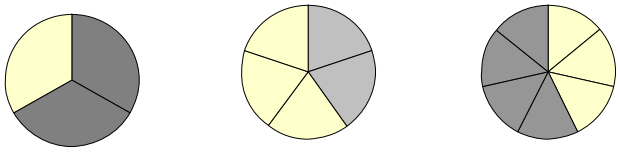
Show What You Know!

Directions: Fill in the missing numbers.

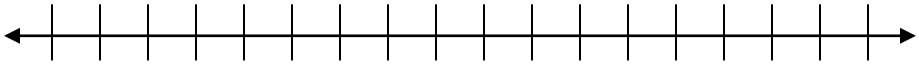
1) 3, 6, ____, _____, 15, ____, _____ 2) 25, 20, ____, _____, 5, ____

3) Identify the fraction of the shaded parts of each shape.



____ ____ ____

4) Label the number line.



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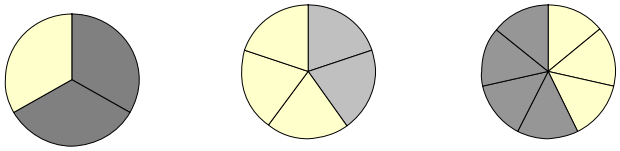
Name _____

Show What You Know!- Answer Key

2) 3, 6, 9, 12, 15, 18, 21

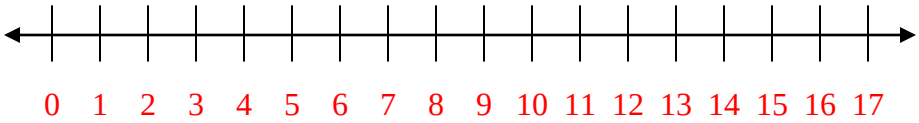
3) 25, 20, 15, 10, 5, 20

4) Identify the fraction of the shaded parts of each shape.



$\frac{2}{3}$ $\frac{2}{5}$ $\frac{4}{7}$

4) Label the number line.



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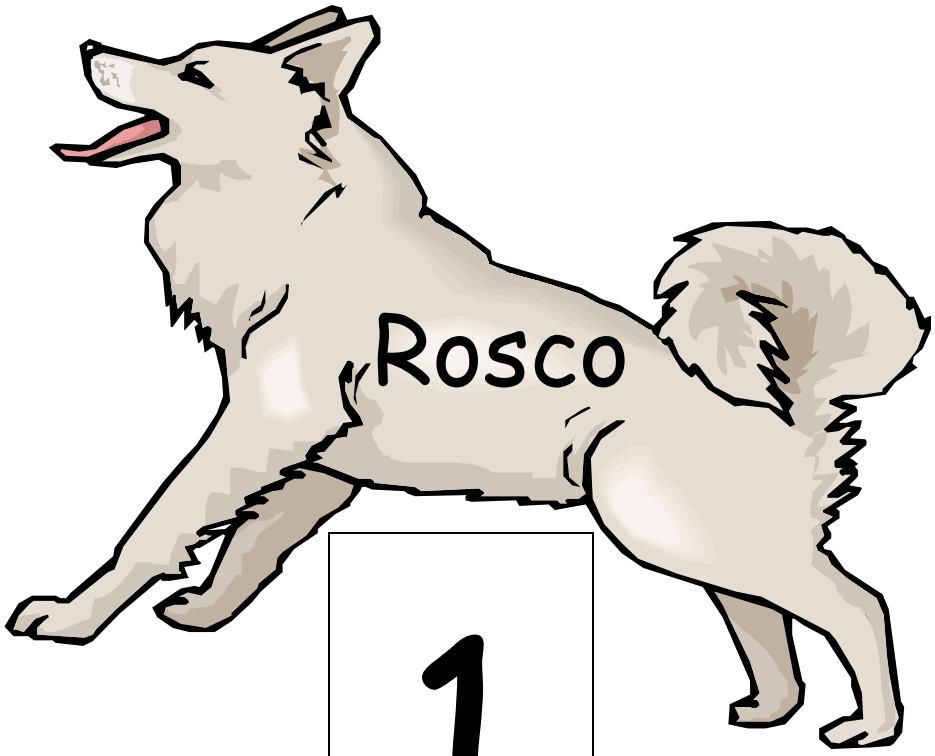

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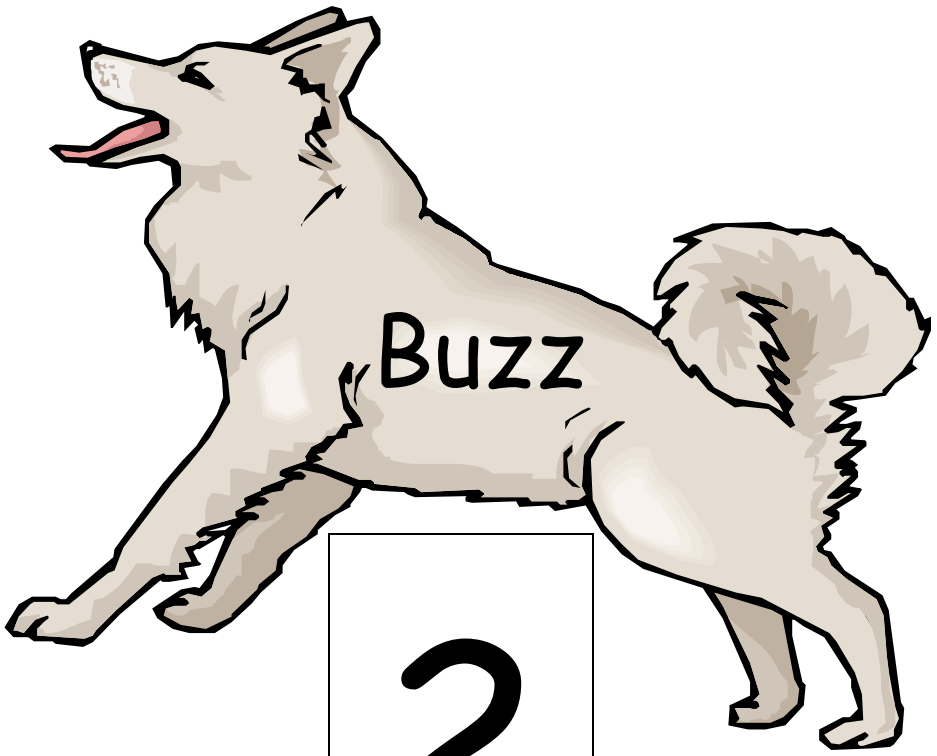

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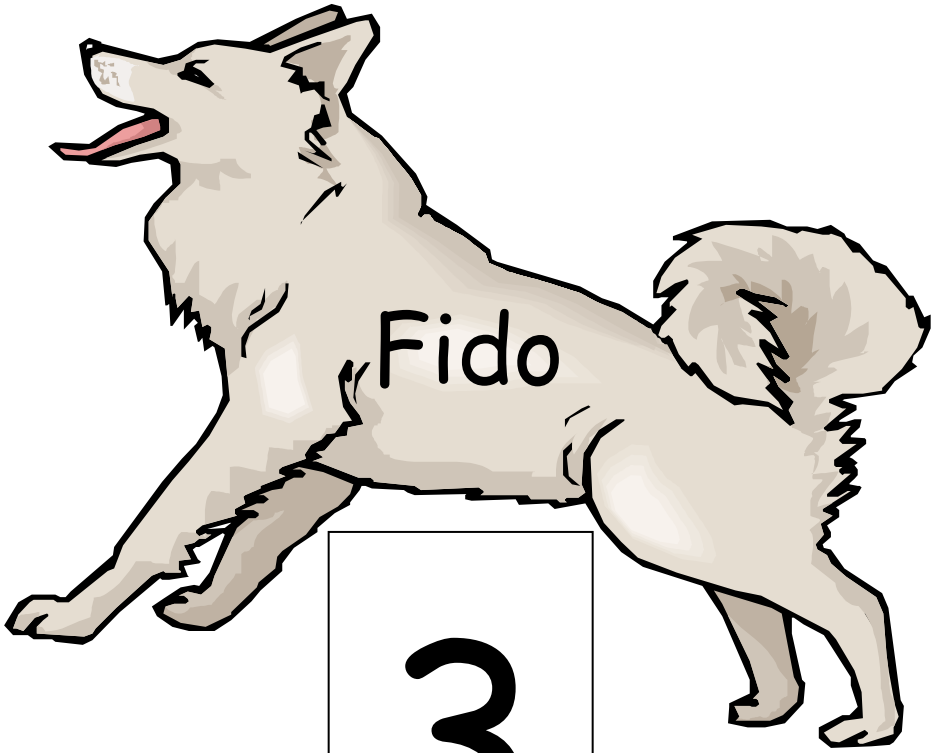

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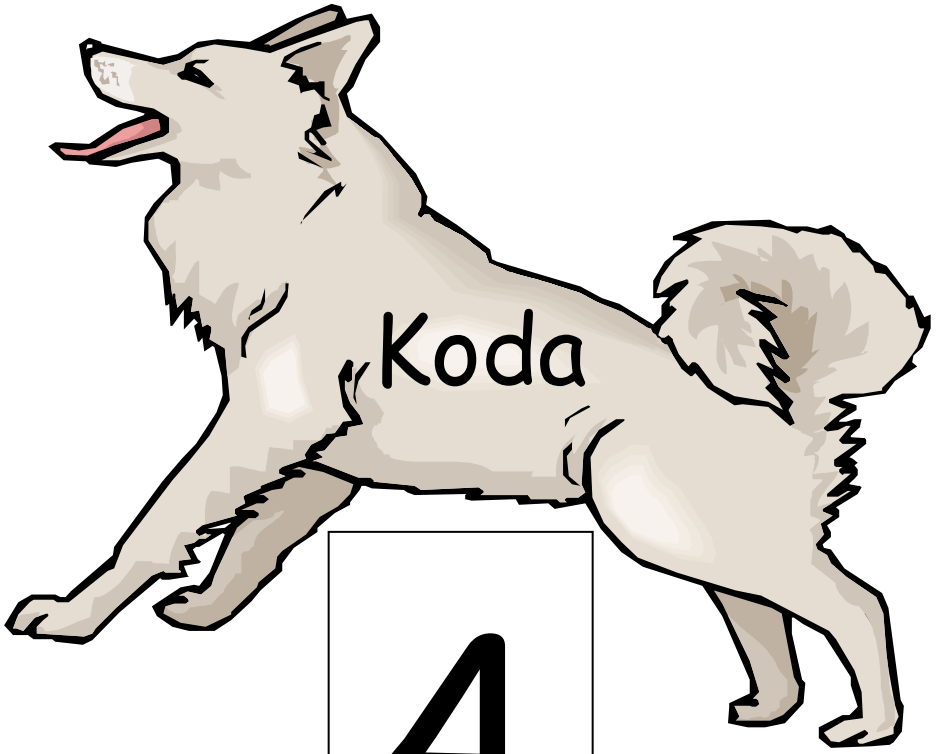

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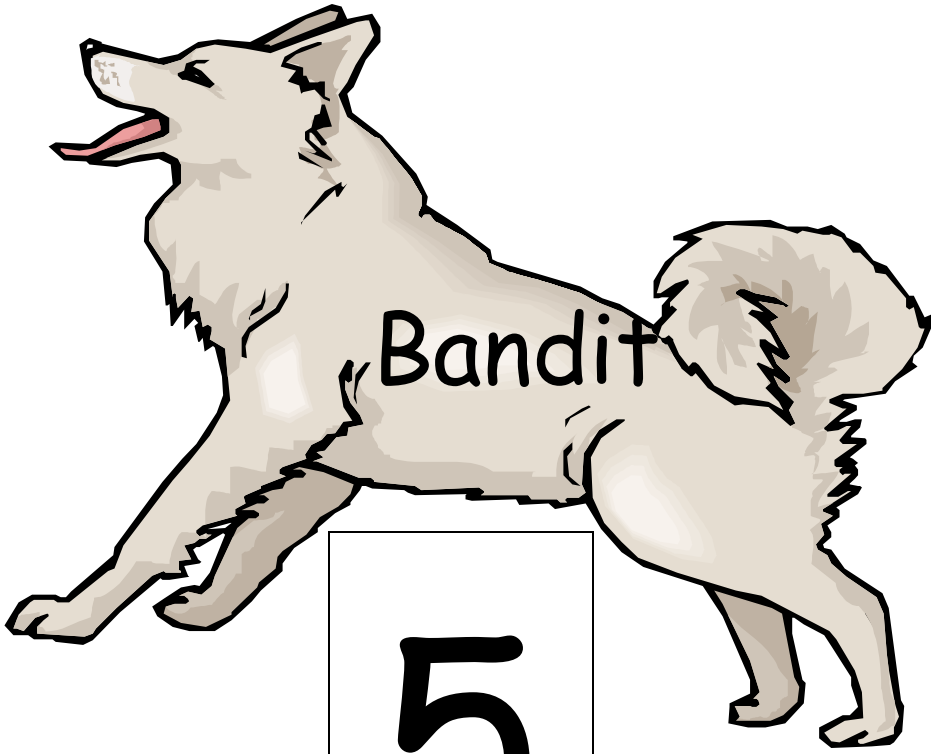

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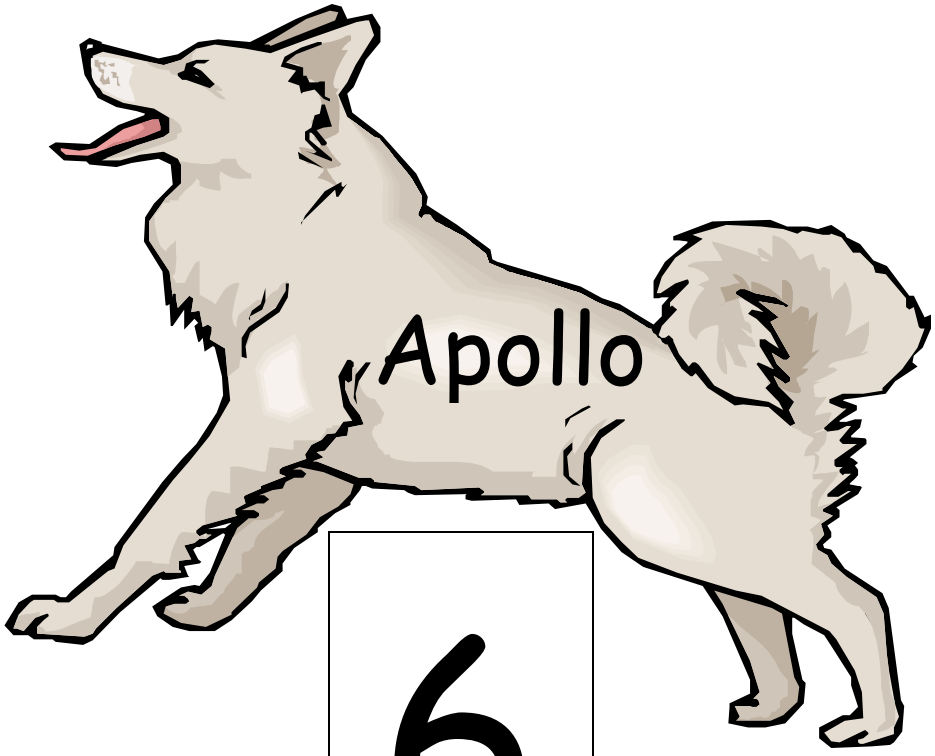

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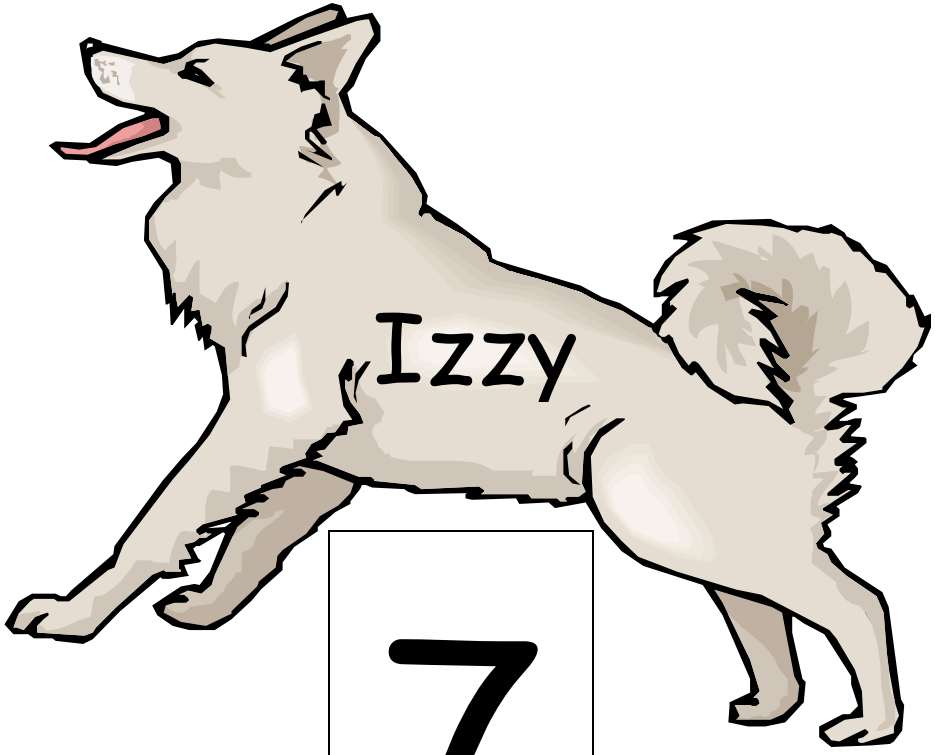

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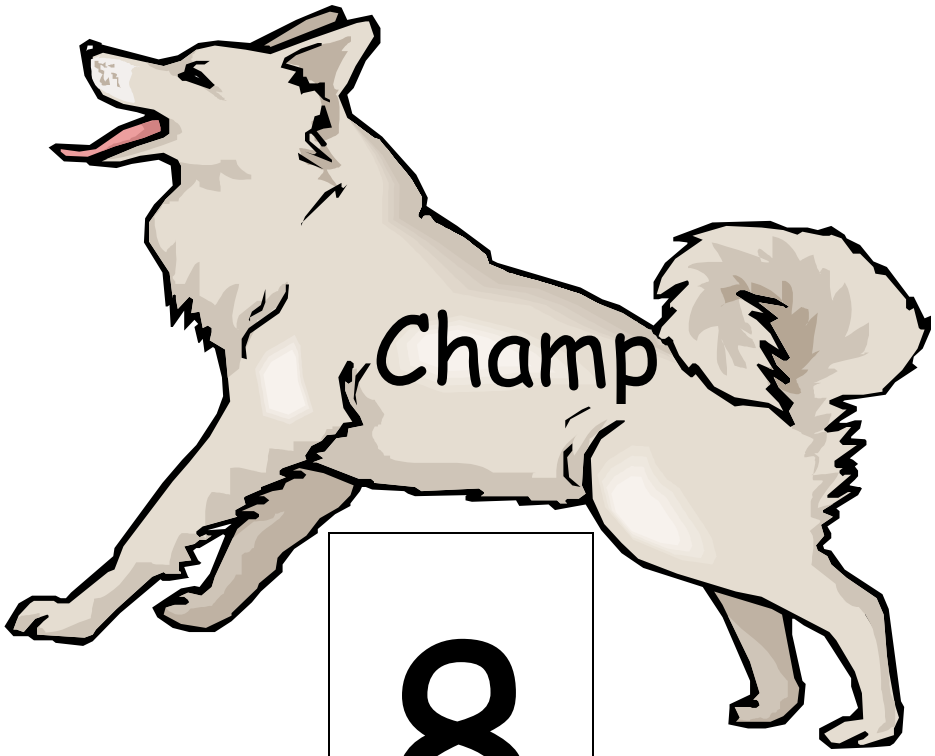

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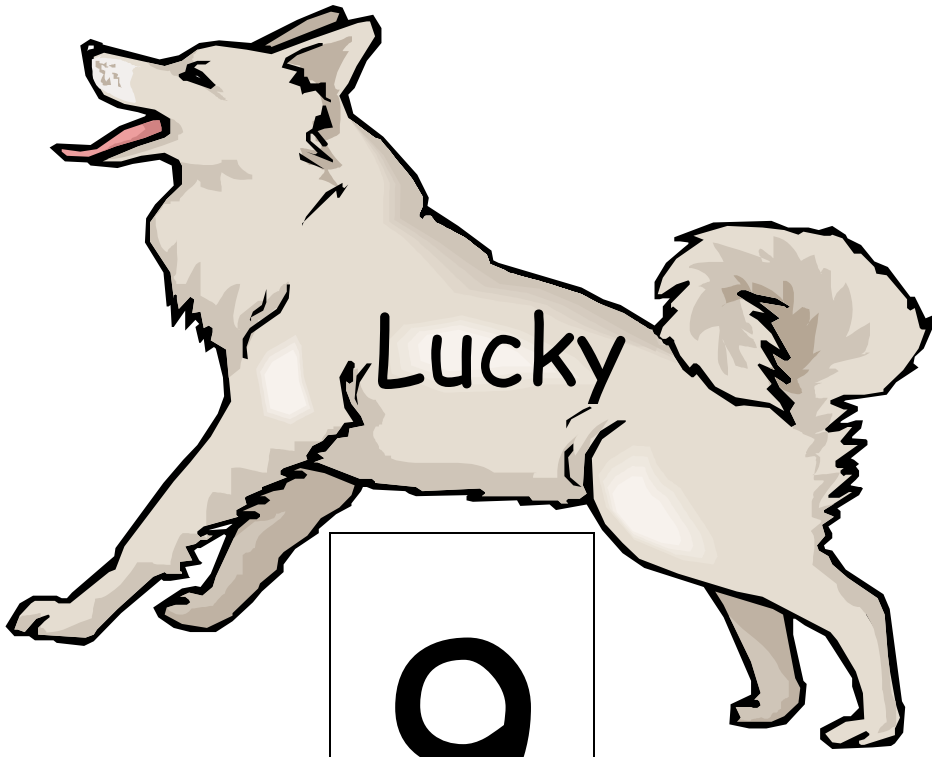

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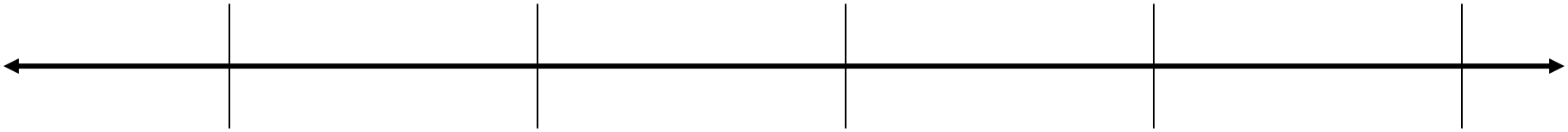
Dave's Disorderly Dogs

Dave is a musher of a dog sled in Alaska, brrr... Every day Dave calls his dogs to line up for that day's work. He says, "Ok, boys, line up and let's get to work!" Unfortunately, Buzz and Rosco always fight to be first in line because they both think they are the best leaders of the team. Bentley and Sparky constantly fuss with each other about being at the end of the line. They want to be close to Dave who is in the back on the sled because he carries the treats. Yummy! Poor Dave is always late for work and his boss is getting very angry. Can you help Dave with his disorderly dog problem?

Them Bones

Place each bone on the number line at the correct location. Then determine the skip counting pattern for the number line. Explain how you determined the pattern.



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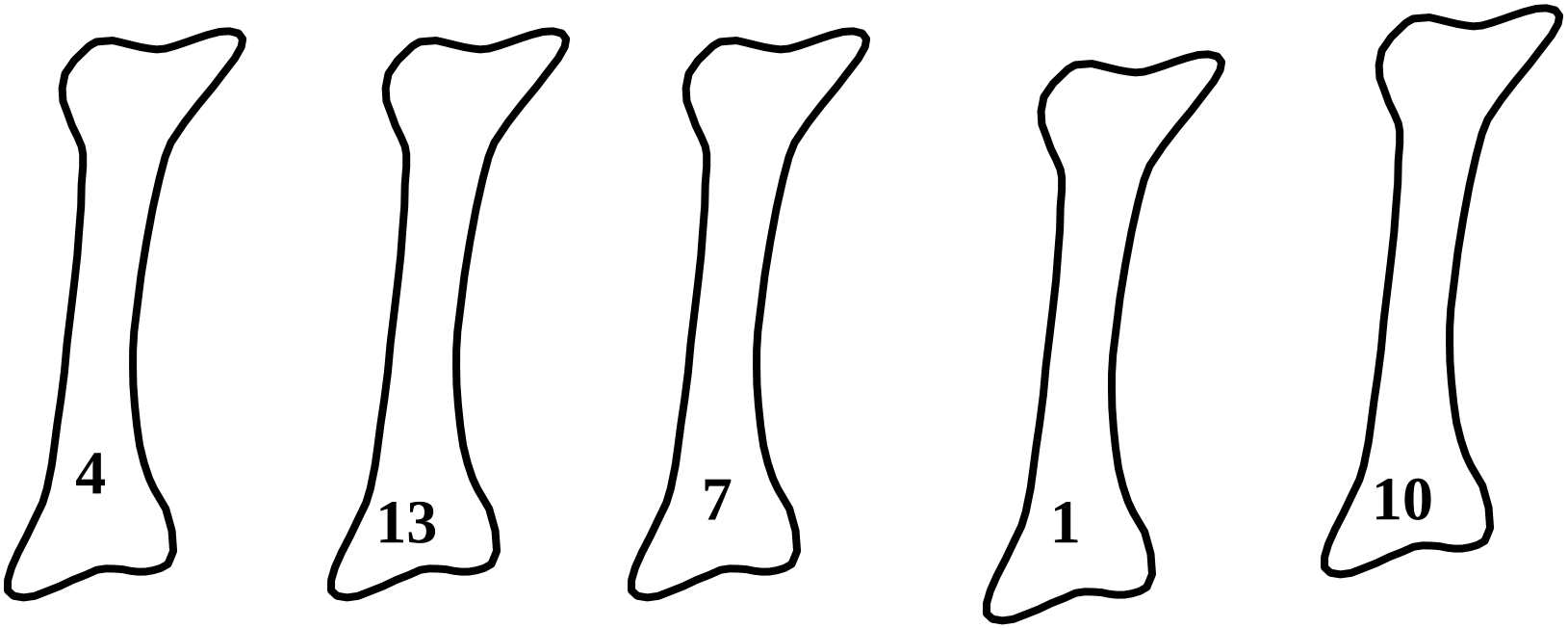

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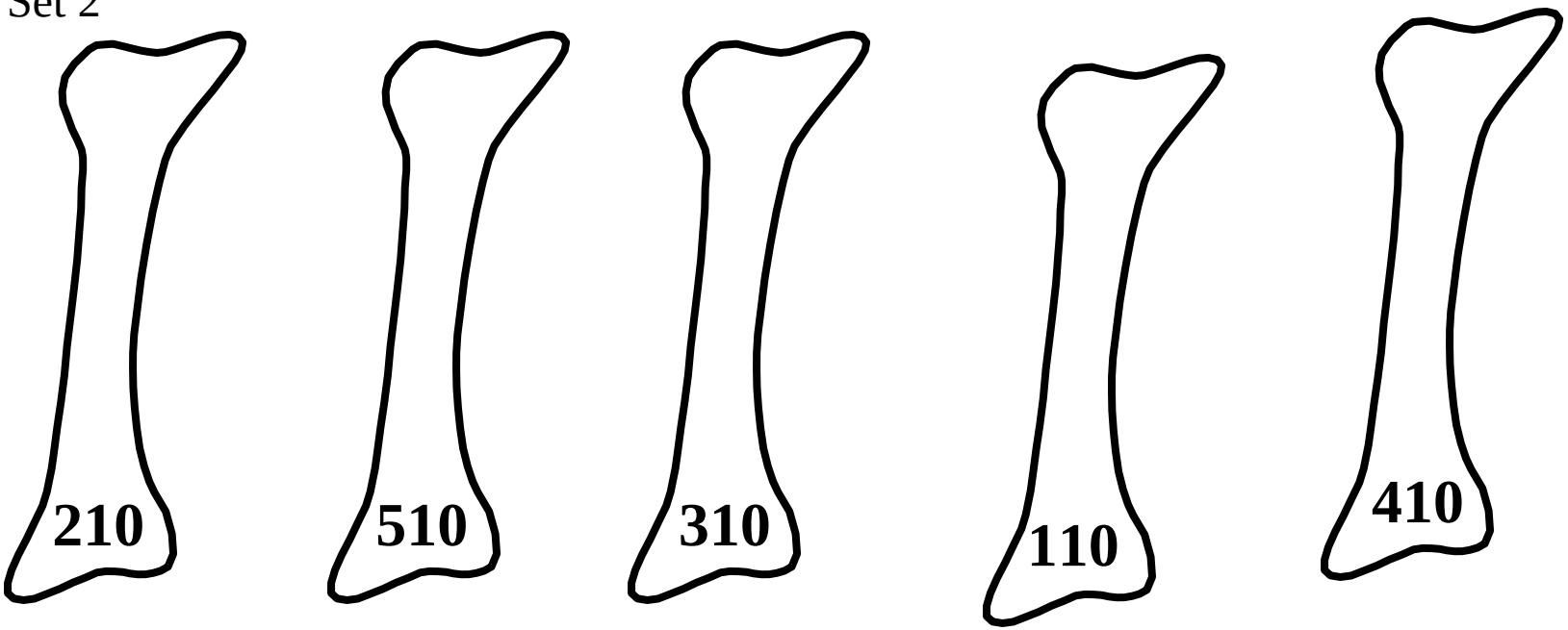

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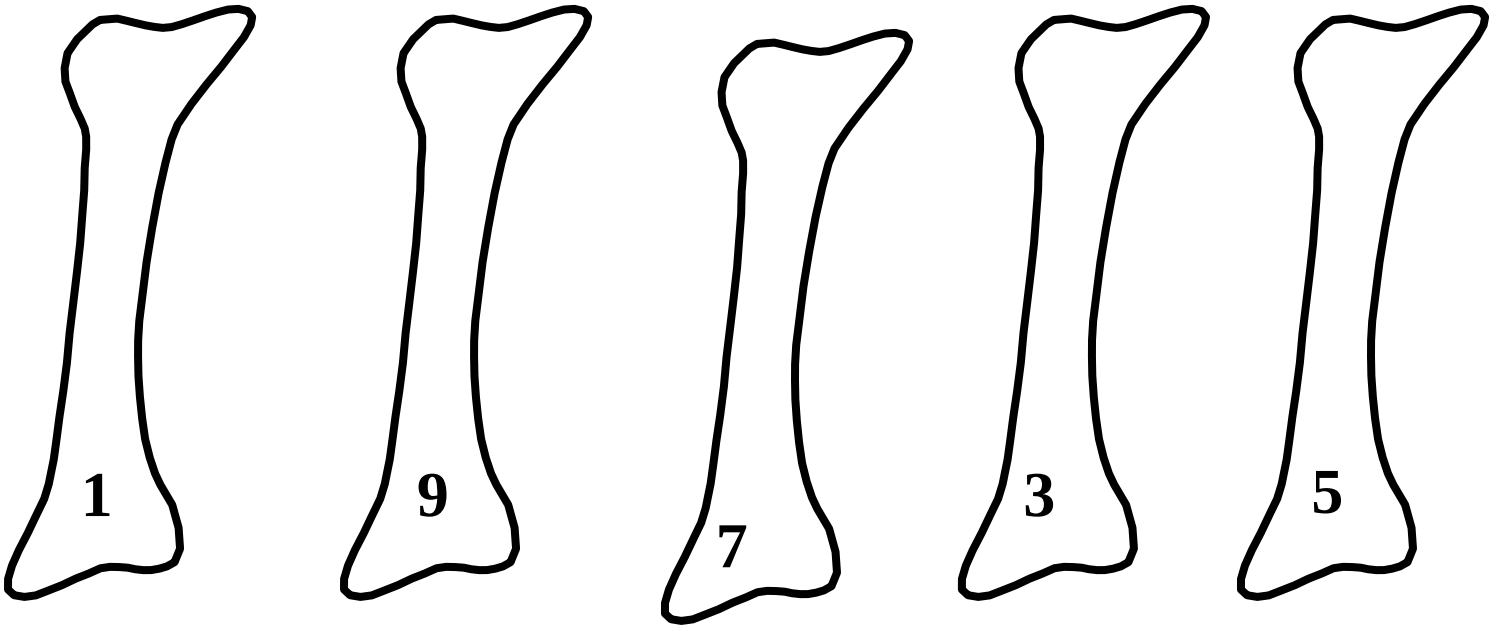

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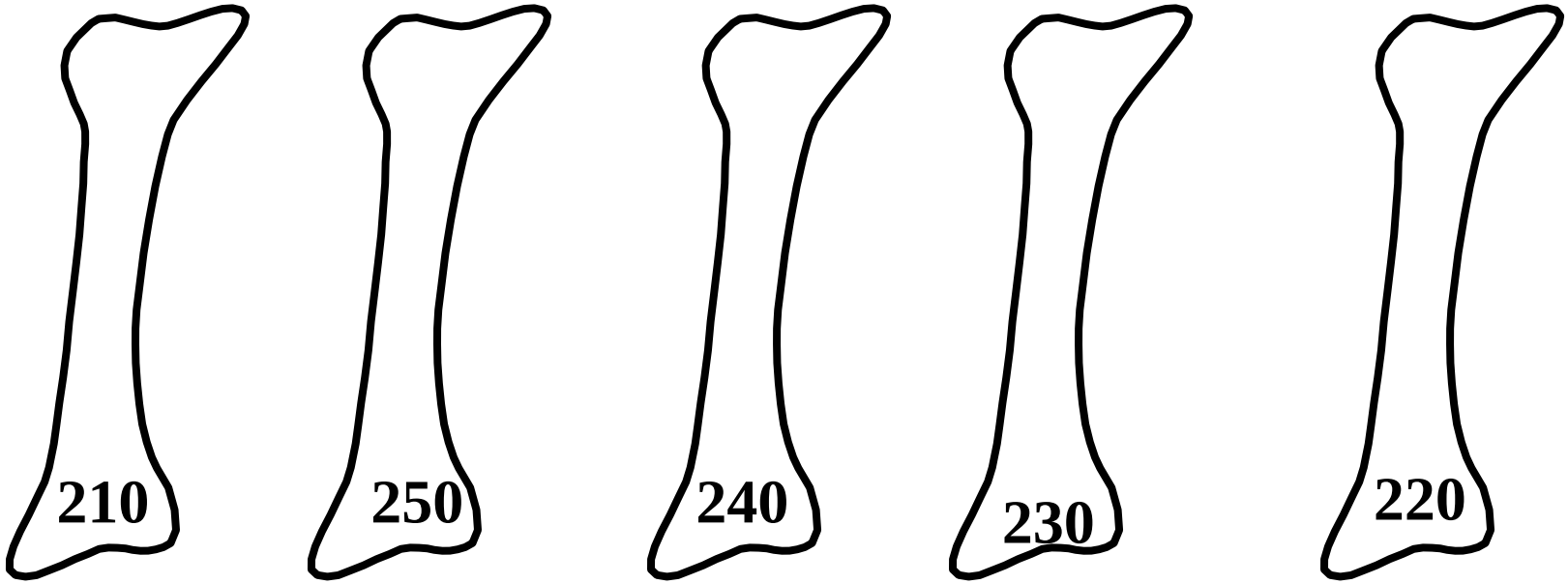

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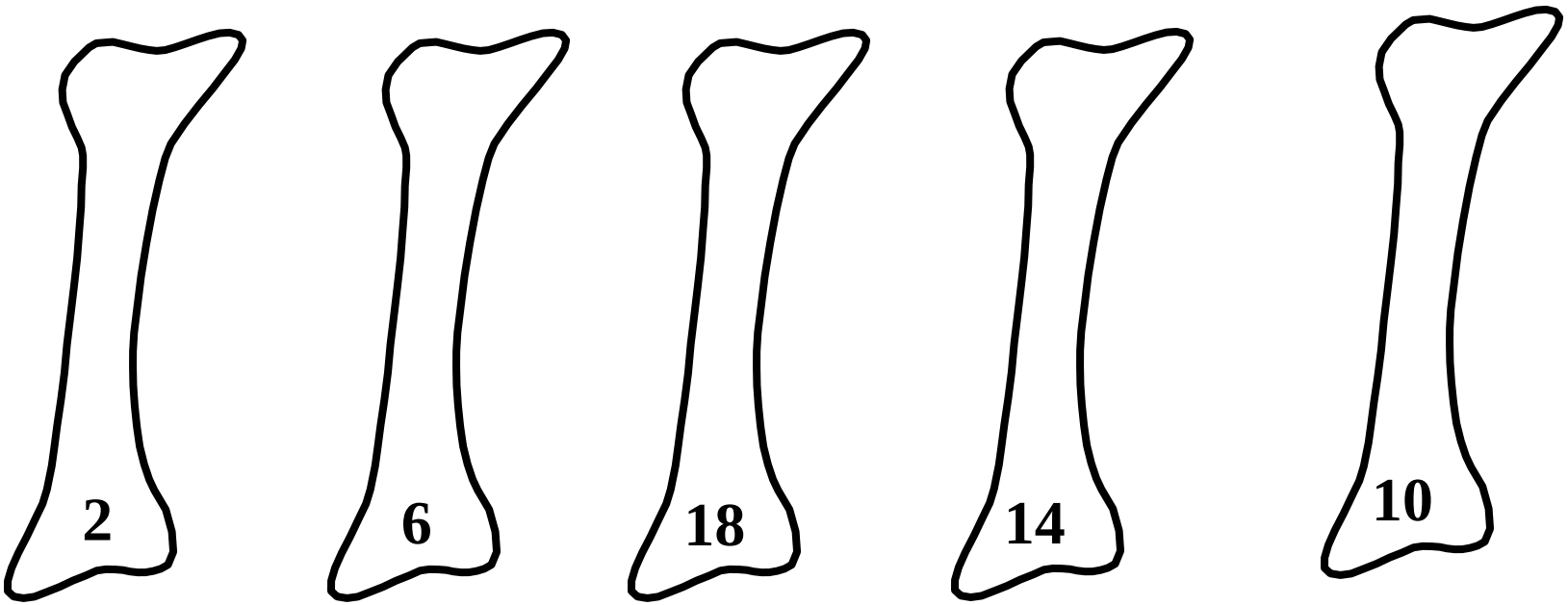

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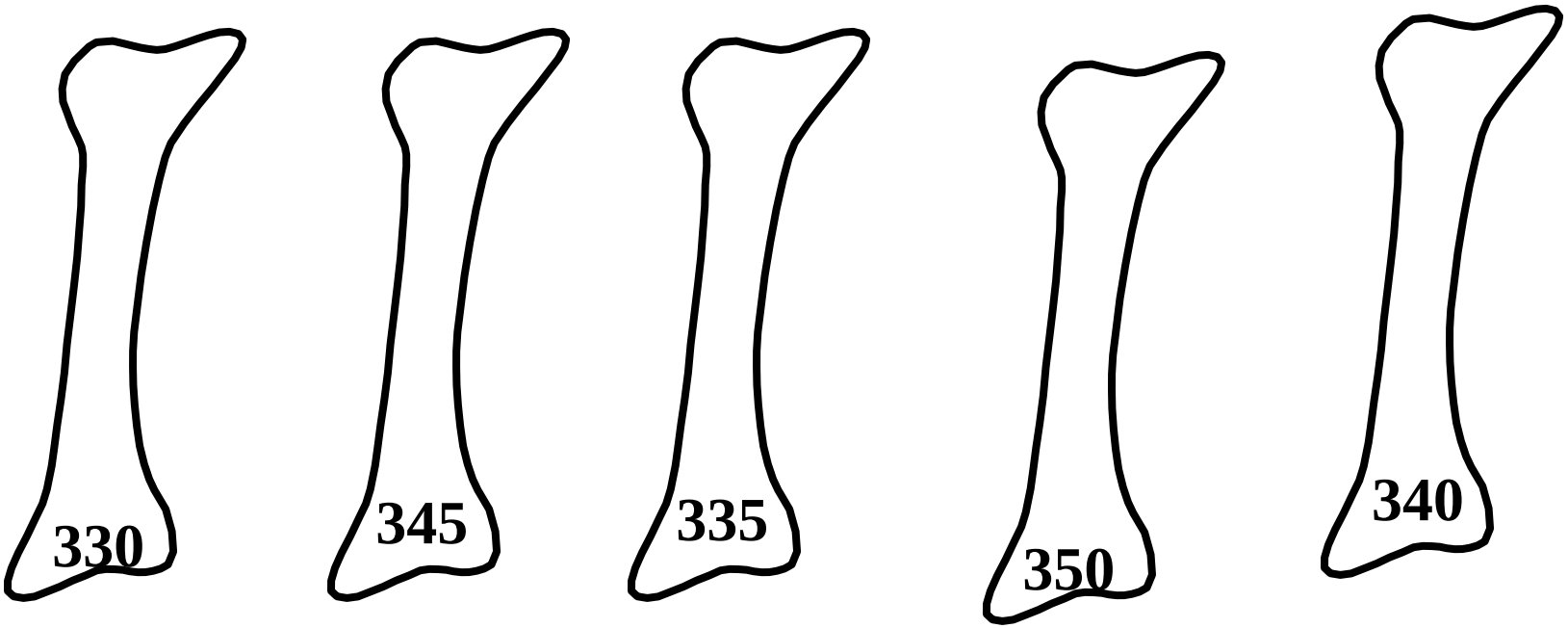


What's the Difference?

Three Steps for Describing & Completing Patterns:

Find the difference between two numbers that are next to each other.

HINT:
Use the counting-up strategy or subtraction!

Use the difference to state the rule for the pattern.

HINT:
Count up by _____
or
Add _____

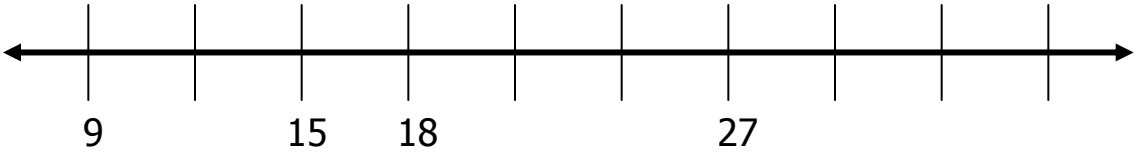
Use the rule to complete the pattern.

Name _____ Date _____

Plotting Points on a Number Lines

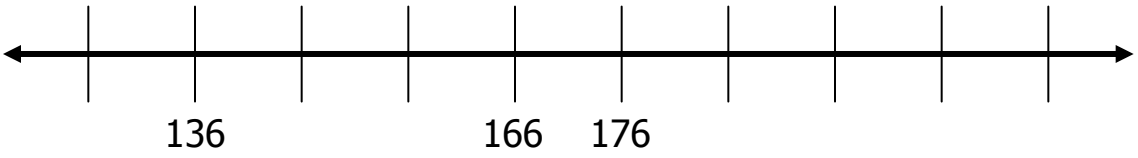
Directions: Find the skip counting pattern and label the missing points on the number line.

1)



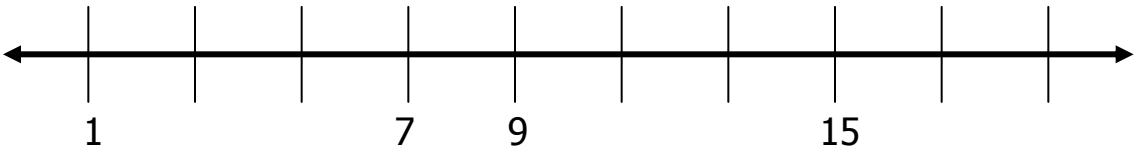
Skip by _____

2)



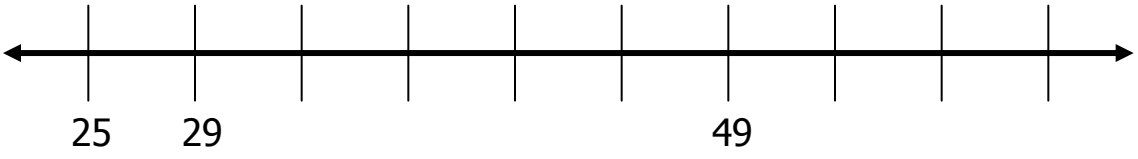
Skip by _____

3)



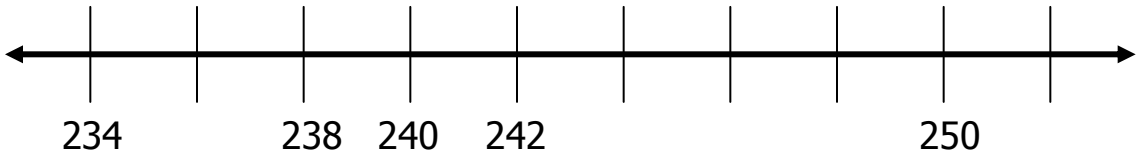
Skip by _____

4)



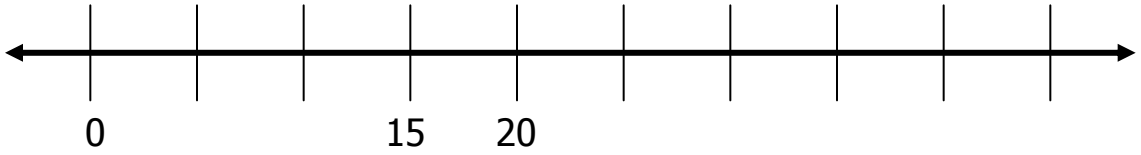
Skip by _____

5)



Skip by _____

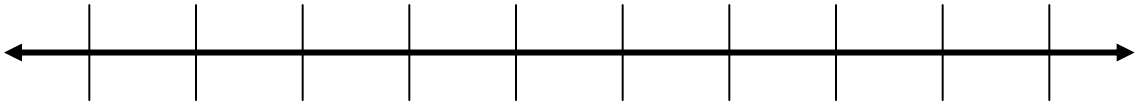
6)



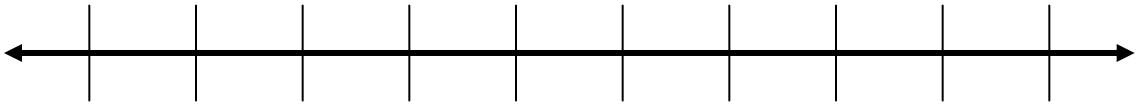
Skip by _____

Challenge:

Create your own number line using a skip counting pattern. The number line must display at least four whole numbers between 250 and 500. The number line should include one skip counting pattern by 2's, 5's, 10's, or 100's.



Skip by _____



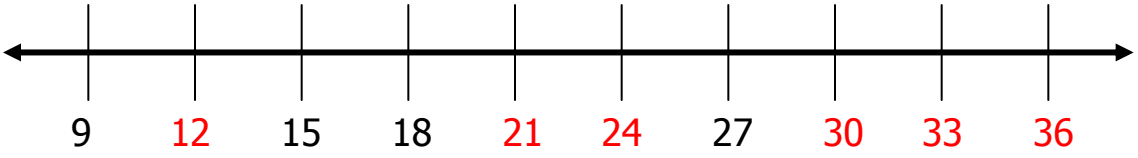
Skip by _____

Name _____ Date _____

Plotting Points on a Number Lines- Answer Key

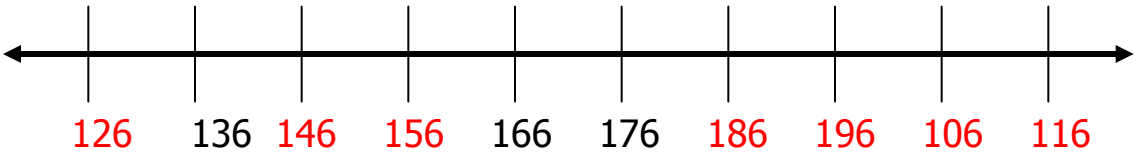
Directions: Find the skip counting pattern and label the missing points on the number line.

1)



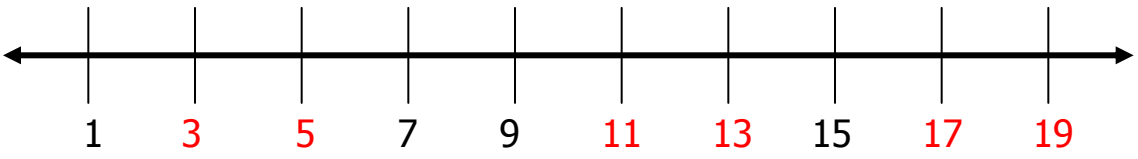
Skip by 3

2)



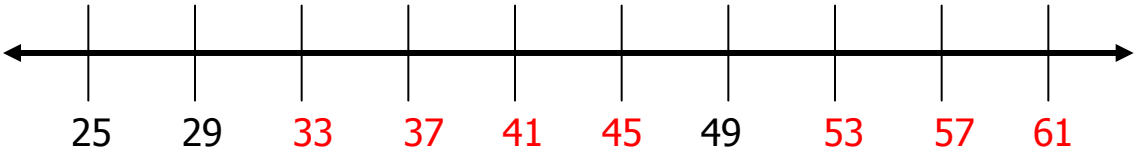
Skip by 10

3)



Skip by 2

4)

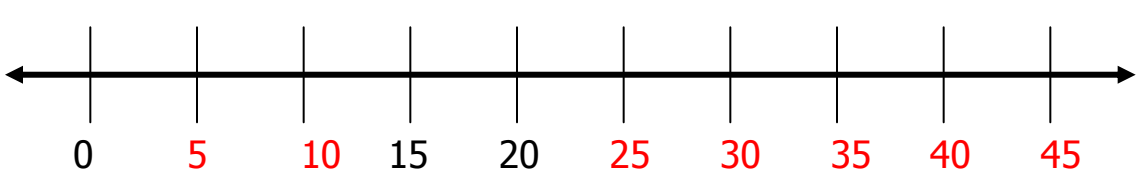


Skip by 4

5)

Skip by 2

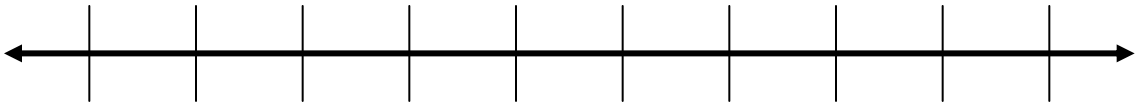
6)



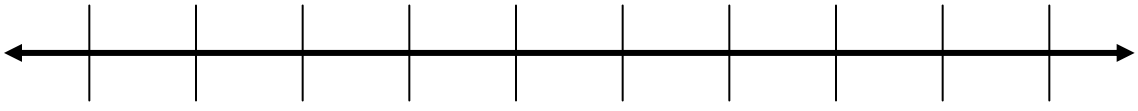
Skip by 5

Challenge: Answers will vary

Create your own number line using a skip counting pattern. The number line must display at least four whole numbers between 250 and 500. The number line should include one skip counting pattern by 2's, 5's, 10's, or 100's.



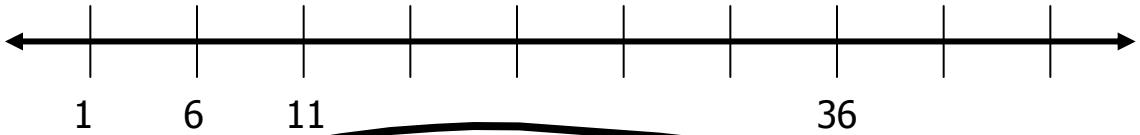
Skip by _____



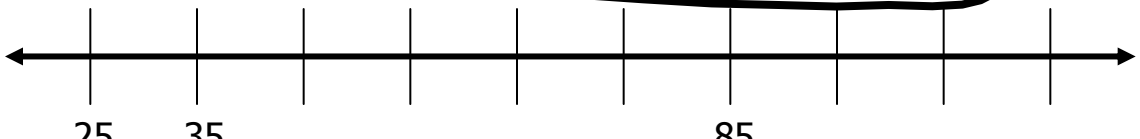
Skip by _____

Number Line Exit Bone

Label the missing points on the number lines.



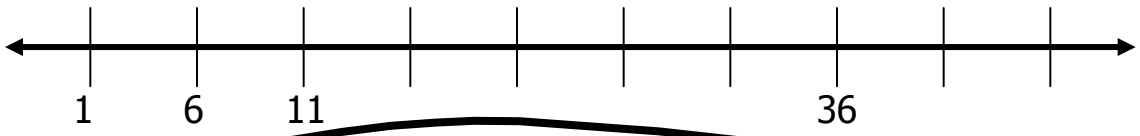
Name _____



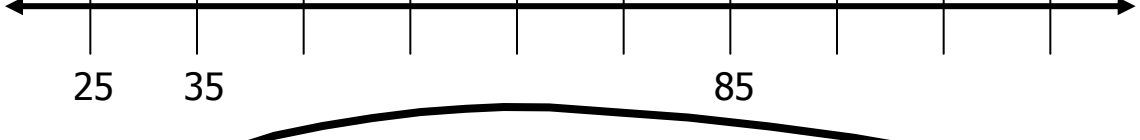
Cut ----------

Number Line Exit Bone

Label the missing points on the number lines.

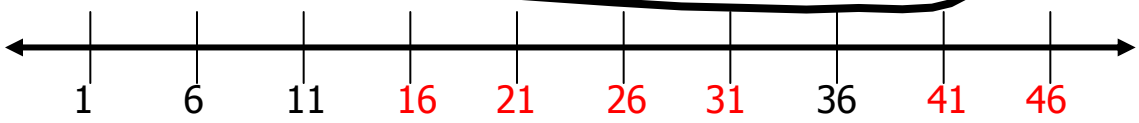


Name _____

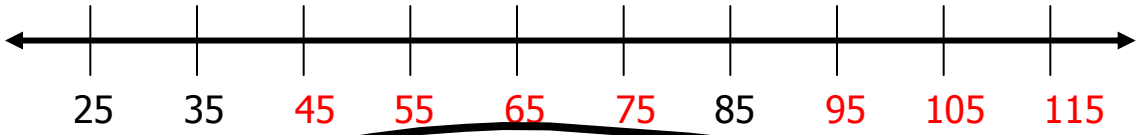


Number Line Exit Bone- Answer Key

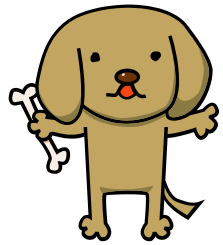
Label the missing points on the number lines.



Name _____



Exploration Number Line Day 2

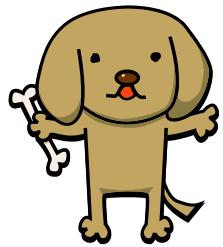


0

1

Cut ----------

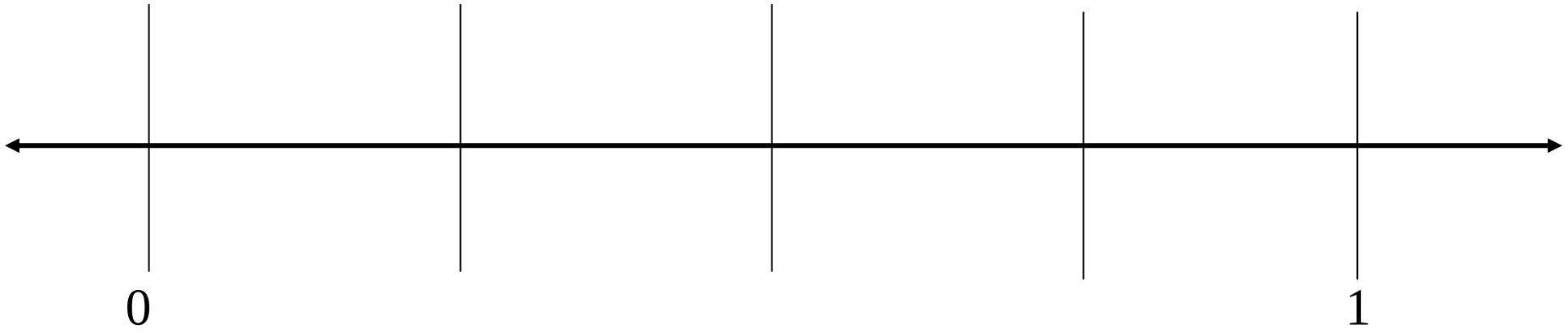
Exploration Number Line Day 2



0

1

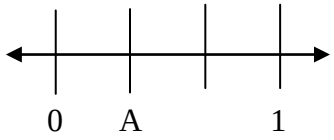
Exploration Number Line Transparency Day 2



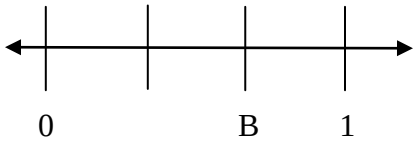
Fractions on a Number Line

Label each letter with a fraction.

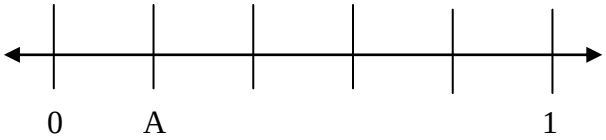
1)



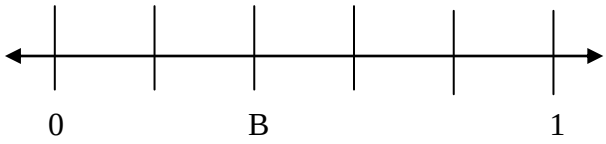
2)



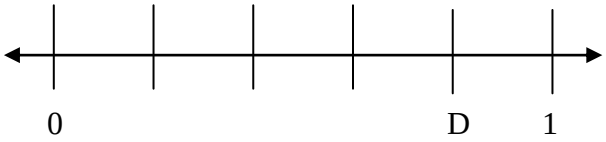
3)



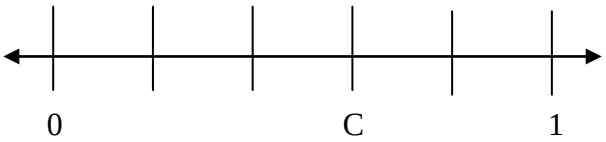
4)



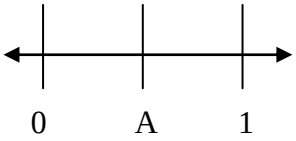
5)



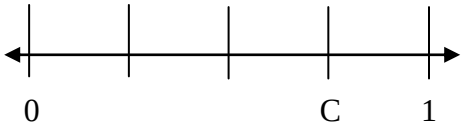
6)

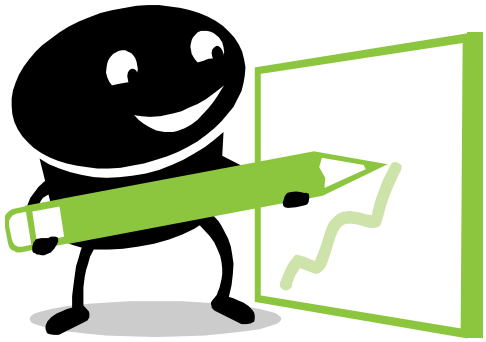


7)



8)



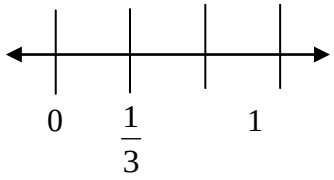


Name _____

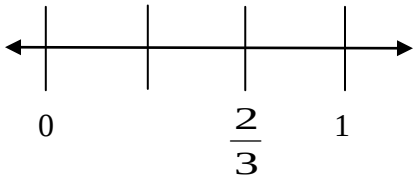
Fractions on a Number Line Answer Key

Label each letter with a fraction.

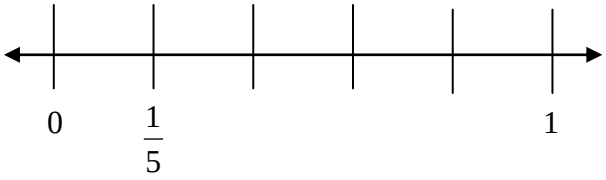
1)



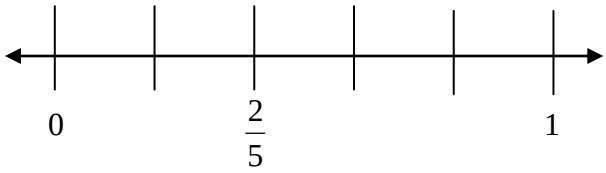
2)



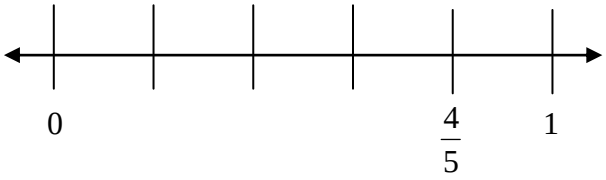
3)



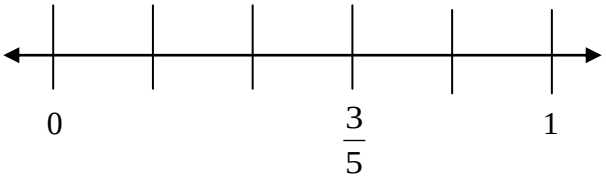
4)



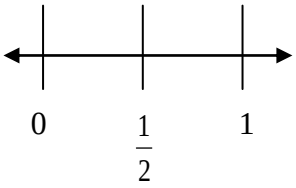
5)



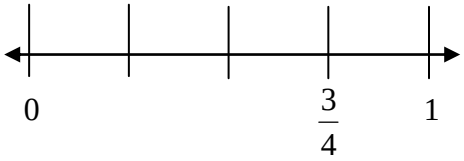
6)

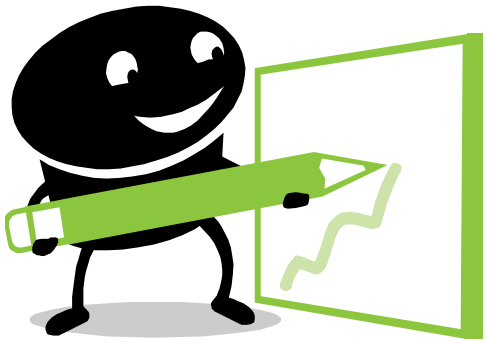


7)



8)

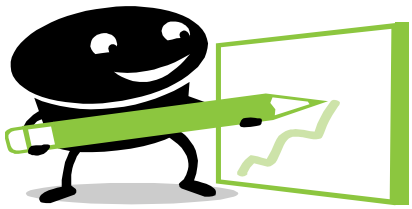




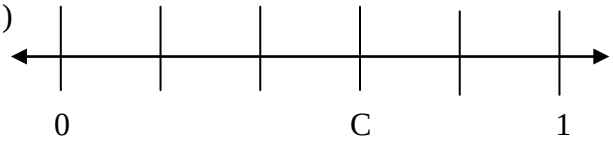
Name _____

Fractions on a Number Line Exit Card

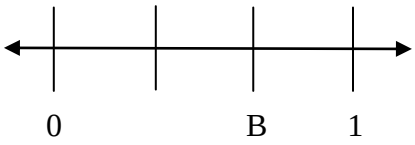
Label each letter with a fraction. Label all of the tick marks for number three.



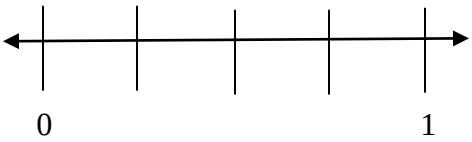
1)



2)



3)

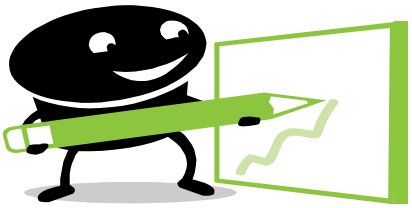


Name _____

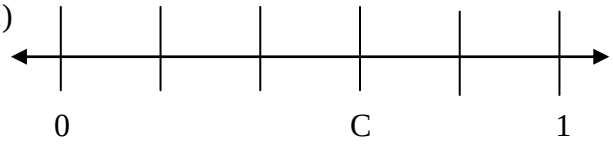
Cut ----------

Fractions on a Number Line Exit Card

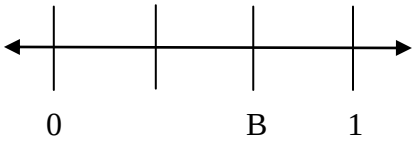
Label each letter with a fraction. Label all of the tick marks for number three.



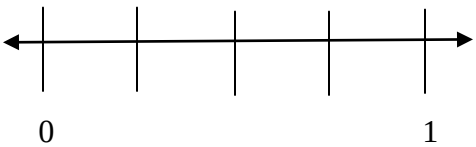
1)



2)



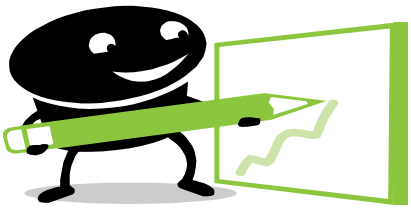
3)



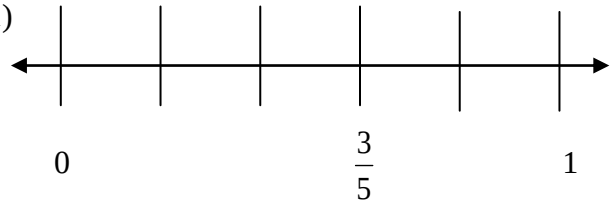
Name _____

Fractions on a Number Line Exit Card Answer Key

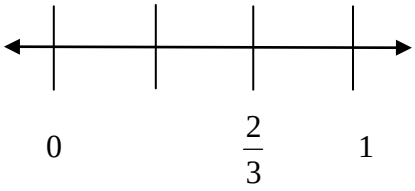
Label each letter with a fraction. Label all of the tick marks for number three.



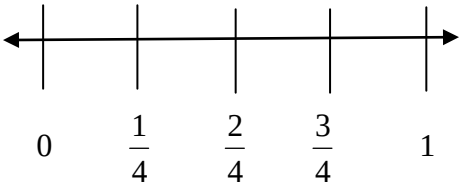
1)



2)



3)



Name _____

0

1

2

3

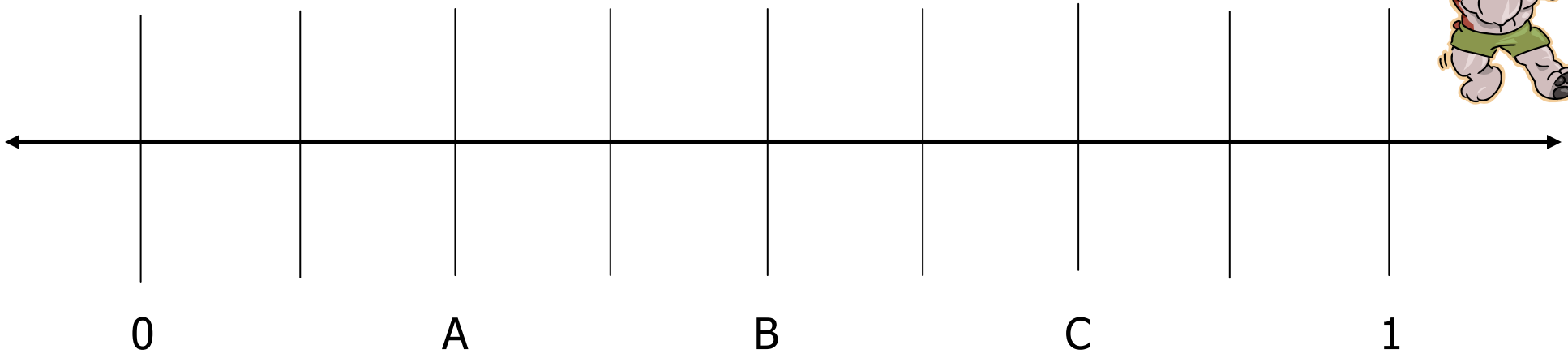
4

Engagement
Whole Number Cards

0	1	$\frac{1}{4}$
$\frac{2}{4}$	$\frac{3}{4}$	

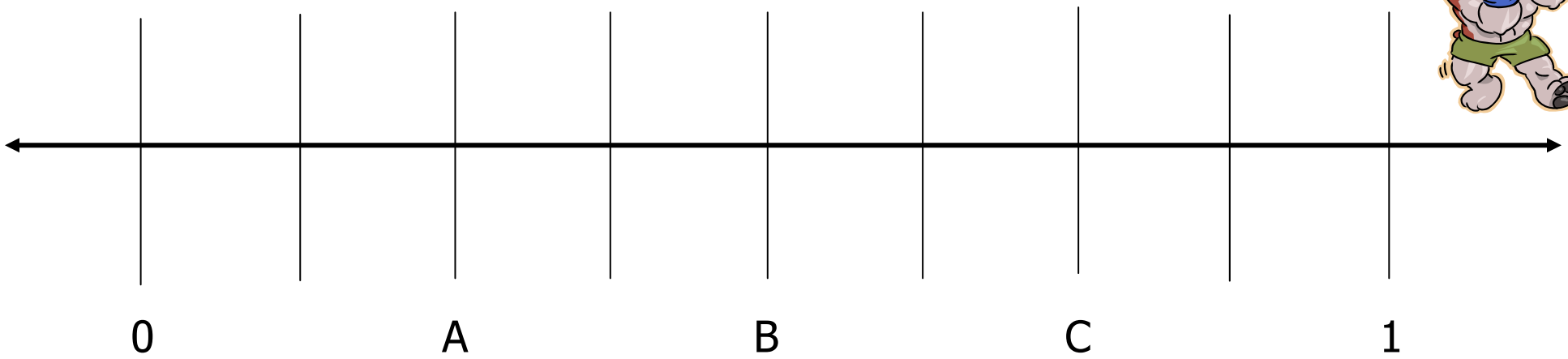
Engagement
Fraction Number Cards

Exploration Number Line Day 3

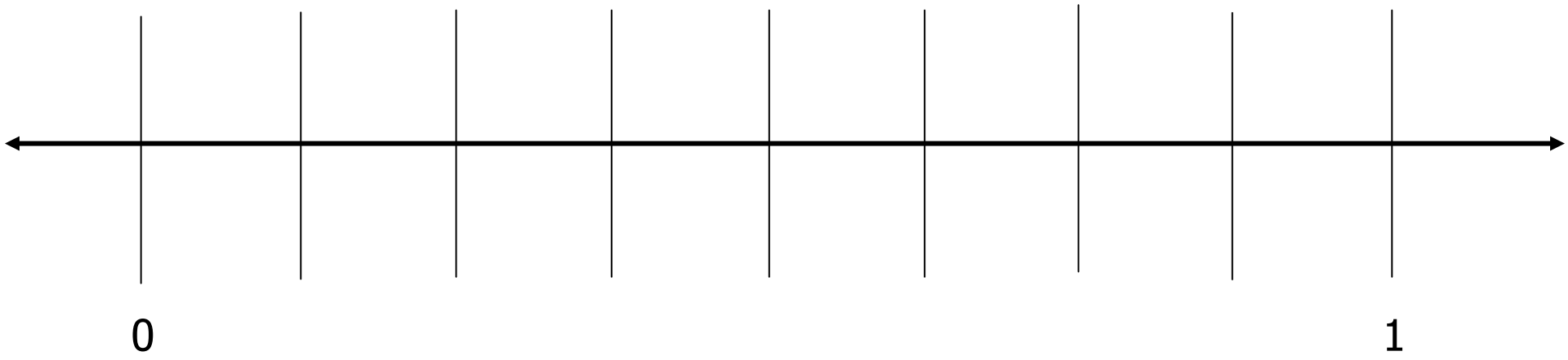


Cut ----------

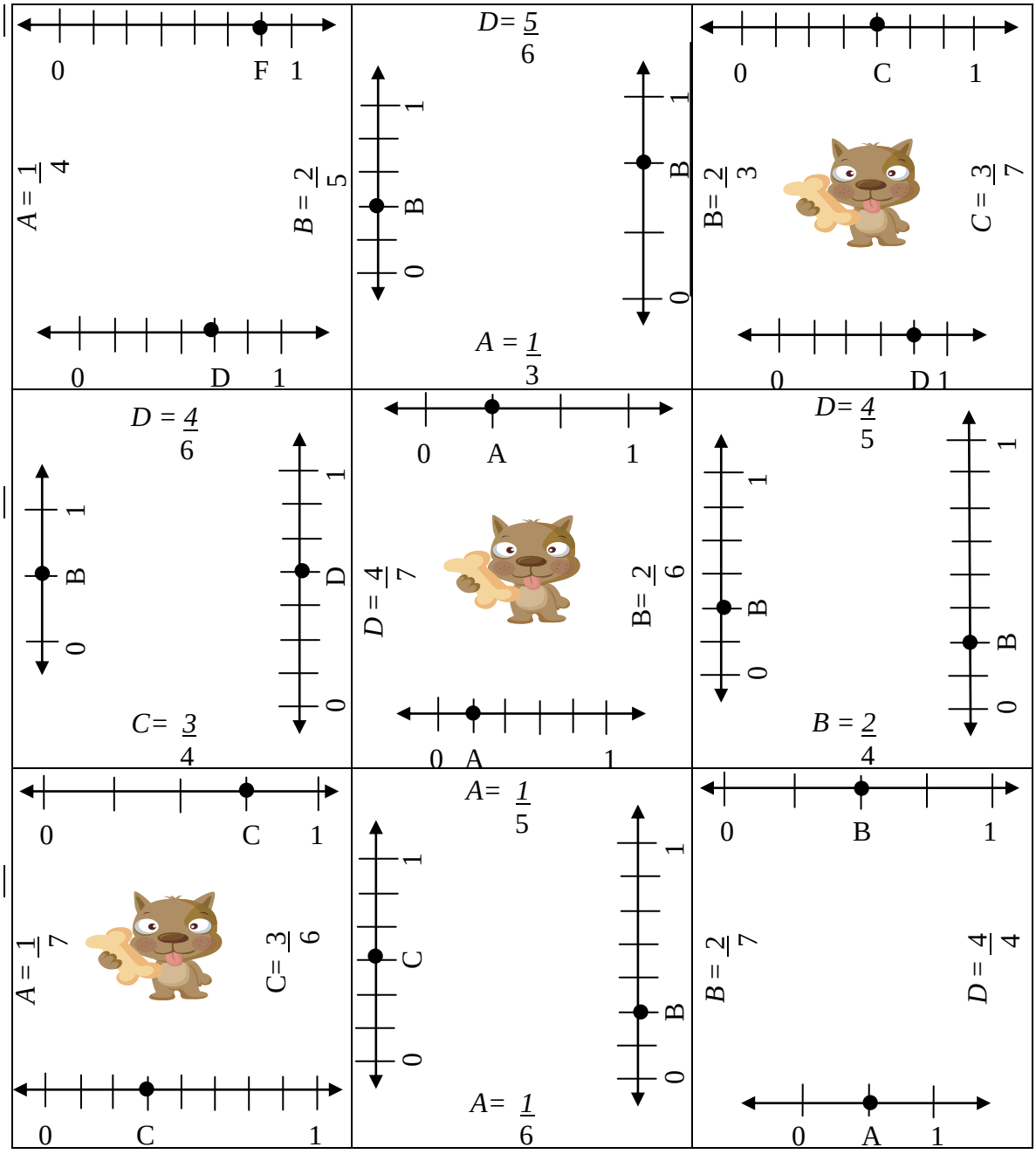
Exploration Number Line Day 3



Exploration Number Line Transparency Day 3



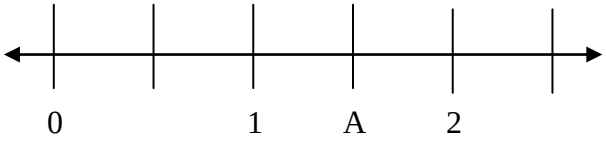
Fraction Square Puzzle



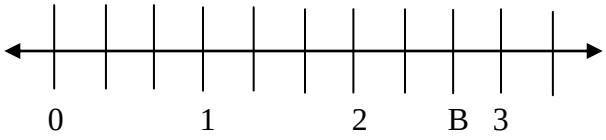
Mixing It Up

Label each letter with a mixed number.

1)



2)



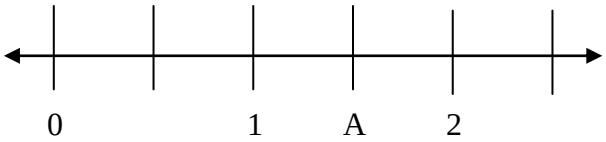
Name _____

Cut ----------

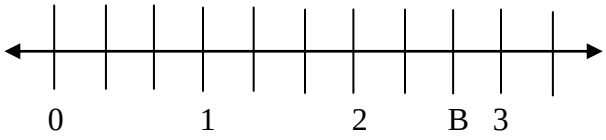
Mixing It Up

Label each letter with a mixed number.

1)



2)

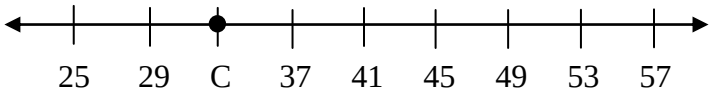


Name _____

Name:_____ Date:_____

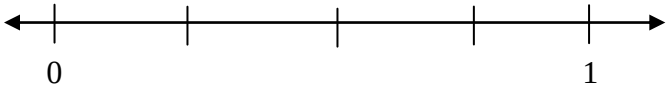
Plotting Points on a Number Line
Summative Assessment

1. Name the whole number represented by point C on the number line below:

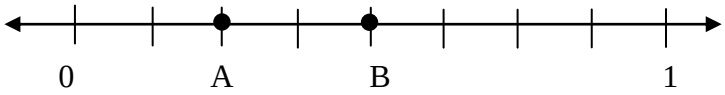


_____

2. Label all the tick marks on the number line below:



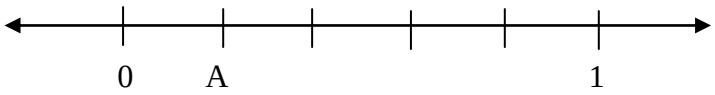
3. Name the fractions represented by points A and B on the number line below:



A= _____ B= _____

Brief Constructed Response

Maria created the number line below.



Part A

What fraction does point A represent on the number line?

_____

Part B

Use what you know about fractions and points on a number line to explain why your answer is correct. Use number and/or words in your explanation.

_____

_____

_____

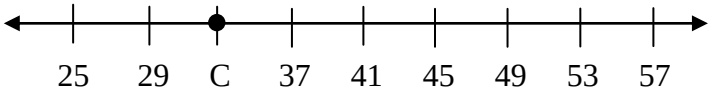
_____

_____

Name:_____ **Date:**_____

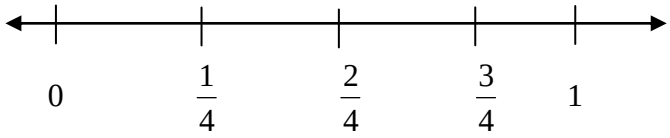
Plotting Points on a Number Line Answer Key
Summative Assessment

4. Name the whole number represented by point C on the number line below:

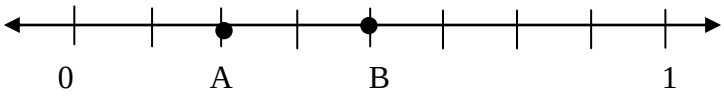


_____33_____

5. Label all the tick marks on the number line below:



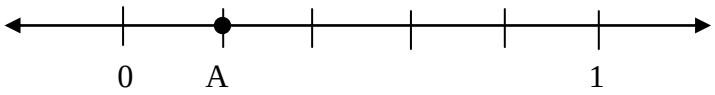
6. Name the fractions represented by points A and B on the number line below:



A= $\frac{2}{8}$ B= $\frac{4}{8}$

Brief Constructed Response Answer Key

Maria created the number line below.



Part A

What fraction does point A represent on the number line?

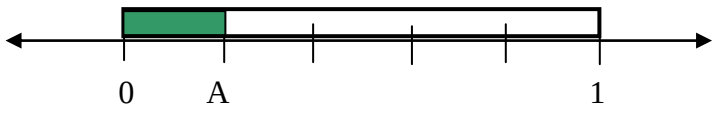
$\frac{1}{5}$

Part B

Use what you know about fractions and points on a number line to explain why your answer is correct. Use number and/or words in your explanation.

Student answers will vary:

Example Student Response:



The number line is labeled 0 to 1 which means that the number line is divided into fractions. There are 5 equal parts of the number line. Five is the denominator. Letter A is at the first shaded part of the number line so the numerator is 1. The fraction is $\frac{1}{5}$.